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Measuring exposure to injury risk in schoolchildren aged 11-14

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Abstract

***Objective*—To apply a measure of exposure to injury risk for schoolchildren aged 11-14 across a population and to examine how risk factors vary with sex, age, and affluence.**

***Design*—Self completion questionnaire survey administered in schools in May 1990.**

***Setting*—24 schools in Newcastle upon Tyne.**

***Subjects*—5334 pupils aged 11-14, of whom 4637 (87%) completed the questionnaire.**

***Results*—Boys were exposed to greater risk than girls in journeys to places to play outdoors: they took longer trips and were more likely to ride bicycles (relative risk 5·30 (95% confidence interval 4·23 to 6·64)) and less likely to travel by public transport or car. Younger pupils (aged 11-12) were less exposed to traffic during journeys to and from school: their journeys were shorter, they were less likely to walk (trip to school, relative risk 0·88 (0·83 to 0·94)), and they were more likely to travel by car (trip to school, relative risk 1·33 (1·13 to 1·56)) or school bus (1·33 (1·10 to 1·62)). Poorer children were exposed to greater risk than affluent children (from families that owned a car and a telephone): they were less likely to travel to school by car (relative risk 0·26 (0·20 to 0·33)) or to be accompanied by an adult (0·39 (0·32 to 0·48)).**

***Conclusion*—Injury risk data can provide useful information on child injury prevention and can be used to identify priorities and target resources for injury prevention on a citywide scale or for an individual school.**

Introduction

The government's strategy document *Health of the Nation* identifies the reduction of "the death rate among children aged under 15 by at least 33% by 2005" (from the baseline rate in 1990) as one of its key targets and calls for the development of local targets.[1] In England childhood unintentional injury is a major public health problem, but injuries are both predictable and preventable.[2]

In order to set local targets good data are needed to build up local pictures of injury problems. For most district health authorities the only information routinely available is that for deaths, but death is too rare an event to provide information on which to base local campaigns. Clearly data on non-fatal injuries are also required. Unfortunately admission to hospital for injury does not accurately reflect the community distribution of injury: selection biases such as bed supply and social class influence admission of all but the most severe injuries.[3] Setting a criterion of severe injury admissions, however, reduces the available data by three quarters.[3] To obtain detailed information at a local level other sources of material are required. Not every child in a community has an injury event, but every child carries some degree of injury risk. Population surveys can thus produce risk profiles for small populations.

We have tried to address the problem of unintentional injury at a local scale in Newcastle by collecting risk data from schoolchildren aged 11-14. We chose this age group because we had recent local evidence that injury rates were highest in this group,[3] because Britain has one of the poorest records in Europe for child pedestrian deaths in the 10-14 age group,[4] and because it is feasible to collect complex material with direct self completion questionnaires. The results provide a baseline profile of injury risk in a community from which a set of achievable goals can be devised.

Subjects and methods

With the cooperation of the local education authority we approached the 24 comprehensive, middle, and special schools in Newcastle, and all took part in the questionnaire survey. All pupils in the relevant classes (years six and eight in middle schools and years seven and nine in the other schools) were involved. Private schools were not included in the survey, but 95% of Newcastle's children attend state schools.

Our survey of injury risk was conducted in 1990 as part of a randomised controlled trial of an injury prevention initiative. This comprised an initial survey of injury risk, a period of intervention when the survey findings were fed back to schools, and an outcome survey of injury risk. Pupils completed the questionnaires during a school lesson supervised by a teacher. Feedback of the data was provided for individual schools by means of tables, bar charts, maps, and pupils' verbatim comments. From these it was possible to compare the individual school's profile with that for the city overall.

We analysed the data with the statistical package, SPSSX and calculated relative risks for different groups according to sex, age, and affluence with the EPIINFO package to identify the most vulnerable groups for different types of risk.[5] The affluence of a pupil's household was assessed by ownership of a car and telephone; households with both were considered affluent, while those with only one or neither were considered deprived. Full tables of the relative risks are available from the authors.

SURVEY QUESTIONNAIRE

The questionnaire was developed to measure children's exposure to causes of fatal and serious injuries and of less severe but common injuries. We consulted teachers and pupils and convened an expert panel (see acknowledgements) to advise on the questionnaire contents. We conducted extensive piloting of the questionnaire in schools. The questionnaire explored exposure to risk from traffic and during leisure activity. It contained seven main sections: biographical details, the trip to school, the trip home

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from school, travelling by car and bicycle, how spare time is spent, sports and games, and attitudes. Here, we report the results for traffic related risk.

Results

Of the 5334 eligible pupils, 4637 (87%) completed the questionnaires, and table I shows their characteristics. Roughly equal proportions of boys and girls and of younger and older pupils completed the questionnaire. The questionnaire did not include a question on ethnic origin, but an analysis of the pupils' names showed that fewer than 5% had Indian, Pakistani, or Chinese names.

JOURNEYS TO AND FROM SCHOOL

The spatial distribution of the homes of boys and girls and of younger and older pupils did not differ appreciably, but the manner in which they travelled to and from school did.

Table II shows details of the pupils' journey to school. There were relatively few differences between boys and girls except that boys were more likely to travel on their own (boys *v* girls, relative risk 1·68 (95% confidence interval 1·49 to 1·88) and to ride a bicycle (relative risk 17·73 (4·27 to 73·55)), and were less likely to be accompanied by children of their own age or younger (relative risk 0·83 (0·79 to 0·88)). There were more differences between the responses for younger and older pupils, with younger pupils being less exposed to the traffic. Younger children's journeys were less likely to take more than 30 minutes (younger *v* older children, relative risk 0·82 (0·70 to 0·96)); they were less likely to walk (relative risk 0·88 (0·83 to 0·94)) and were more likely to travel by car (relative risk 1·33 (1·13 to 1·56)) or school bus (relative risk 1·33 (1·10 to 1·62)); and this meant they were more likely not to have to cross any roads on their way to school (relative risk 1·26 (1·04 to 1·52)). Affluent pupils had longer journey times to school than deprived pupils, but in many other respects the deprived pupils were more exposed to risk. Fewer deprived children travelled to school by car (deprived *v* affluent children, relative risk 0·26 (0·20 to 0·33)), and fewer were accompanied to school by an adult (relative risk 0·39 (0·32 to 0·48)). The deprived pupils were more likely to travel by school bus (relative risk 1·25 (1·03 to 1·51)).

Table III shows details of the pupils' journey home. The journey home from school is known to be more dangerous than the trip to school.[6] Journey times were longer on the trip home. More pupils walked home than walked to school (journey home *v* journey to school, relative risk 1·08 (1·04 to 1·13)), and fewer travelled home by car (relative risk 0·66 (0·58 to 0·75)). Fewer children walked home alone than walked alone to school (relative risk 0·78 (0·72 to 0·85)), fewer were accompanied by an adult (relative risk 0·66 (0·58 to 0·75)), and more were accompanied by children of their own age or younger (relative risk 1·14 (1·11 to 1·18)). More roads were crossed on the way home. Comparisons by sex, age, and affluence were, however, broadly similar for the trips home and to school.

TRIP TO PLAY OUTDOORS

Table IV shows details of the children's most recent journey to play outdoors. More boys had longer trips to where they played or spent some time compared with girls. The most striking differences were in modes of travel: boys were more likely to travel by bicycle (boys *v* girls, relative risk 5·30 (4·23 to 6·64)) but were less likely to use the bus (relative risk 0·66 (0·58 to 0·76)), metro (relative risk 0·58 (0·44 to 0·76)), or car (relative risk 0·67 (0·54 to 0·83)). Boys and girls had similar pedestrian exposure to traffic, with more girls saying that they had crossed a busy road. Younger pupils were less likely to use the bus (younger *v* older pupils, relative risk 0·61 (0·53 to 0·69)) or metro (relative risk 0·37 (0·28 to 0·50)) and were more likely to use a bicycle (relative risk 1·44 (1·22 to 1·69)). They also had lower exposure to the road environment, crossing busy roads less often (relative risk 0·74 (0·69 to 0·80)), crossing fewer roads (relative risk 0·56 (0·46 to 0·68)), and fewer taking more than 20 minutes on their trips

TABLE I—*Characteristics of schoolchildren aged 11-14 in state schools in Newcastle upon Tyne. Values are numbers of children unless stated otherwise*

	Total population (n=5334)	Respondents (n=4637)	% Response
Sex:			
Boys	2673	2338	87
Girls	2655	2299	87
Missing data	6	0	
Age (years):			
11-12	2695	2376	88
13-14	2639	2261	86
Missing data	0	0	
Ethnic origin:			
Indian	217	189	87
Chinese	35	28	80
Other	5082	4420	87
Missing data	0	0	
School type:			
Middle	1612	1499	93
Special	117	88	75
Comprehensive	3605	3050	85
Household:			
Affluent*		2865	
Deprived		1781	

*Ownership of car and telephone.

TABLE II—*Details of morning journey to school by 4637 pupils aged 11-14 in Newcastle upon Tyne by sex, age, and affluence. Values are percentages (No of pupils)*

	Sex		Age (years)		Household		
	Boys	Girls	11-12	13-14	Deprived	Affluent*	Total
Journey time >30 min (n=4628)†	12·8 (297)	10·9 (250)	10·7 (253)	13·0 (294)	10·0 (178)	12·9 (369)	11·8 (547)
Mode of transport (n=4631†):							
Walked	45·2 (1054)	46·7 (1073)	43·2 (1024)	48·8 (1103)	48·5 (861)	44·4 (1266)	45·9 (2127)
Public transport (bus, metro)	33·8 (789)	33·7 (774)	33·9 (805)	33·6 (758)	36·5 (648)	32·1 (915)	33·8 (1563)
School bus	8·8 (206)	8·1 (185)	9·6 (228)	7·2 (163)	9·6 (171)	7·7 (220)	8·4 (391)
Car	11·1 (259)	11·5 (265)	12·9 (305)	9·7 (219)	4·1 (72)	15·8 (452)	11·3 (524)
Bicycle	1·5 (36)	0·1 (2)	0·8 (19)	0·8 (19)	0·9 (16)	0·8 (22)	0·8 (38)
Accompanied by (n=4620†):							
Alone	26·1 (607)	15·5 (356)	18·9 (448)	22·9 (515)	22·9 (406)	19·6 (557)	20·8 (963)
Child same age or younger	53·1 (1238)	63·8 (1460)	57·1 (1352)	59·7 (1346)	57·7 (1021)	58·9 (1677)	58·4 (2698)
Older child	11·4 (266)	12·3 (281)	16·5 (391)	6·9 (156)	11·9 (211)	11·8 (336)	11·8 (547)
Adult	10·6 (248)	12·6 (288)	14·0 (331)	9·1 (205)	5·9 (104)	15·2 (432)	11·6 (536)
No of roads crossed (n=4431†):							
None	10·1 (224)	8·3 (185)	10·3 (232)	8·2 (177)	6·4 (108)	11·0 (301)	9·2 (409)
>5	16·5 (365)	17·8 (396)	14·7 (333)	19·7 (428)	17·2 (292)	17·2 (469)	17·2 (761)
Busy road crossed (n=4391†):	69·6 (1533)	70·7 (1547)	67·6 (1518)	72·9 (1562)	72·7 (1243)	68·5 (1837)	70·1 (3080)
Not using crossing facility to cross busy road (n=2980†)	43·6 (644)	40·9 (615)	40·5 (595)	43·9 (664)	47·4 (569)	38·8 (690)	42·2 (1259)

*Ownership of car and telephone. †No of pupils who answered the question.

TABLE III—*Details of journey home from school by 4637 pupils aged 11-14 in Newcastle upon Tyne by sex, age, and affluence. Values are percentages (No of pupils)*

	Sex		Age (years)		Household		
	Boys	Girls	11-12	13-14	Deprived	Affluent*	Total
Journey time >30 min (n=4521†)	16·4 (375)	15·3 (342)	15·2 (349)	16·6 (368)	13·5 (232)	17·3 (485)	15·9 (717)
Mode of transport (n=4601†):							
Walked	48·6 (1125)	51·0 (1165)	46·0 (1082)	53·8 (1208)	52·9 (930)	47·9 (1360)	49·8 (2290)
Public transport (bus, metro)	32·4 (750)	33·9 (774)	33·6 (790)	32·7 (734)	33·6 (591)	32·8 (933)	33·1 (1524)
School bus	9·5 (220)	7·2 (164)	9·4 (222)	7·2 (162)	9·5 (167)	7·6 (217)	8·3 (384)
Car	7·9 (182)	7·0 (160)	9·9 (234)	4·8 (108)	2·4 (43)	10·5 (299)	7·4 (342)
Bicycle	1·5 (35)	0·1 (3)	0·7 (16)	1·0 (22)	0·8 (14)	0·8 (24)	0·8 (38)
Accompanied by (n=4580†):							
Alone	19·4 (447)	13·1 (298)	16·6 (389)	15·9 (356)	19·2 (335)	14·5 (410)	16·3 (745)
Child same age or younger	64·3 (1480)	69·1 (1573)	62·7 (1469)	70·8 (1584)	64·9 (1133)	67·7 (1920)	66·7 (3053)
Older child	9·3 (214)	8·7 (197)	12·4 (290)	5·4 (121)	9·2 (161)	8·8 (250)	9·0 (411)
Adult	8·0 (185)	7·3 (166)	10·4 (243)	4·8 (108)	3·9 (68)	10·0 (283)	7·7 (351)
No of roads crossed (n=4392†):							
None	9·4 (205)	6·2 (137)	9·2 (205)	6·4 (137)	6·2 (104)	8·8 (238)	7·8 (342)
>5	18·8 (412)	20·4 (448)	16·7 (373)	22·6 (487)	19·6 (328)	19·6 (532)	19·6 (860)
Busy road crossed (n=4302†):	70·1 (1497)	74·5 (1613)	70·5 (1538)	74·2 (1572)	72·8 (1224)	72·0 (1886)	72·3 (3110)
Not using crossing facility to cross busy road (n=2965†)	47·1 (669)	40·2 (621)	40·5 (588)	46·4 (702)	45·0 (524)	42·6 (766)	43·5 (1290)

*Ownership of car and telephone. †No of pupils who answered the question.

TABLE IV—*Details of most recent journey to play outdoors by 4637 pupils aged 11-14 in Newcastle upon Tyne by sex, age, and affluence. Values are percentages (No of pupils)*

	Sex		Age (years)		Household		
	Boys	Girls	11-12	13-14	Deprived	Affluent*	Total
Journey time >20 min (n=4210†)	18·3 (393)	16·8 (348)	14·2 (304)	21·1 (437)	17·3 (275)	17·8 (466)	17·6 (741)
Mode of transport (n=4535†):							
Walked	60·9 (1392)	64·6 (1453)	65·5 (1512)	59·9 (1333)	67·6 (1174)	59·7 (1671)	62·7 (2845)
Bus	13·9 (317)	20·9 (470)	13·2 (304)	21·7 (483)	19·8 (344)	15·8 (443)	17·4 (787)
Car	5·6 (129)	8·4 (189)	7·4 (170)	6·7 (148)	3·3 (57)	9·3 (261)	7·0 (318)
Bicycle	19·8 (452)	3·7 (84)	13·9 (321)	9·7 (215)	7·5 (130)	14·5 (406)	11·8 (536)
Metro	3·5 (81)	6·1 (138)	2·6 (61)	7·1 (158)	4·8 (83)	4·9 (136)	4·8 (219)
No of roads crossed (n=4007†)	9·4 (200)	9·0 (191)	6·6 (144)	11·8 (247)	9·5 (157)	9·0 (234)	9·2 (391)
Busy roads crossed (n=4007†)	37·6 (750)	40·7 (819)	33·4 (668)	44·9 (901)	39·6 (619)	38·9 (950)	39·2 (1569)

*Ownership of car and telephone. †No of pupils who answered the question.

TABLE V—*Details of travel by car and bicycle by 4637 pupils aged 11-14 in Newcastle upon Tyne by sex, age, and affluence. Values are percentages (No of pupils)*

	Sex		Age (years)		Household		
	Boys	Girls	11-12	13-14	Deprived	Affluent*	Total
Household car ownership (n=4557†)	70·5 (1618)	67·2 (1519)	68·5 (1587)	69·2 (1550)	16·5 (281)	100 (2856)	66·8 (3137)
Car used in past two days (n=4543†)	44·3 (1013)	41·0 (925)	42·5 (982)	42·8 (956)	22·5 (385)	54·8 (1553)	42·7 (1938)
Seat belt worn in car:							
On last trip (n=4445†)	74·2 (1658)	70·4 (1557)	71·9 (1618)	72·8 (1597)	61·5 (1013)	78·7 (2202)	72·3 (3215)
In front seat (n=2131†)	92·9 (1130)	96·4 (882)	95·6 (871)	93·5 (1141)	91·7 (505)	95·4 (1507)	94·4 (2012)
In back seat (n=2199†)	49·9 (478)	50·6 (628)	54·3 (693)	44·7 (413)	44·3 (459)	55·6 (647)	50·3 (1106)
Cycle used in past week (n=4573†)	60·3 (1392)	33·1 (751)	52·3 (1218)	41·2 (925)	44·6 (772)	48·2 (1371)	46·9 (2143)
Took part in cycle proficiency course (n=4569†)	39·9 (920)	29·3 (663)	33·4 (781)	35·9 (802)	27·1 (469)	39·3 (1114)	34·6 (1583)
Cycle helmet used (n=4015†)	3·8 (79)	2·0 (40)	4·2 (84)	1·8 (35)	2·6 (39)	3·2 (80)	3·0 (119)
Fluorescent clothing used (n= 4002†)	10·1 (209)	9·9 (193)	12·7 (255)	7·4 (147)	8·5 (128)	10·9 (274)	10·0 (402)
Reflective clothing used (n=3985†)	11·6 (238)	9·8 (190)	14·2 (283)	7·3 (145)	10·0 (150)	11·2 (278)	10·7 (428)

*Ownership of car and telephone. †No of pupils who answered the question.

(relative risk 0·67 (0·59 to 0·77)). There were fewer differences between the affluent and the deprived pupils, particularly in exposure to the road environment. Deprived pupils, however, were less likely to travel by car (deprived *v* affluent pupils relative risk 0·35 (0·27 to 0·47)) or by bicycle (relative risk 0·52 (0·43 to 0·62)) and were more likely to travel by bus (relative risk 1·25 (1·10 to 1·42)) or to walk (relative risk 1·13 (1·08 to 1·18)).

TRAVELLING BY CAR AND BICYCLE

Table V shows details of pupils' travel by car and bicycle. There were few differences in car ownership relating to gender or age. All the affluent households and 281 (16·5%) of the deprived households had a car. Fewer of the deprived pupils had travelled by car in the previous two days compared with affluent pupils (relative risk 0·41 (0·37 to 0·45)). We asked the pupils whether they wore a seat belt and whether they sat in the front or back seat on their previous journey. Boys wore seat belts less often than girls in the front seat (relative risk 0·96 (0·95 to 0·98)), but similar proportions wore seat belts in the back seat. Girls were much more likely to travel in the back seat (66% compared with 33% of boys), and, as seat belt wearing was more common in the front, the net effect was that boys wore seat belts more often when travelling in cars. Younger pupils showed little difference from older pupils in seat belt use in the front seat (younger *v* older pupils, relative risk 1·02 (1·00 to 1·04)) but used seat belts more than older pupils in the back seat (relative risk 1·21 (1·11 to 1·32)). Deprived pupils were less likely to use a seat belt in the back than affluent children (relative risk 0·80 (0·73 to 0·87)).

Boys were nearly twice as likely as girls to have ridden a bicycle in the previous week (boys *v* girls, relative risk 1·82 (1·70 to 1·95)) and were more likely than girls to have taken part in a cycle proficiency

course (relative risk 1·37 (1·26 to 1·48)) and to wear a cycle helmet (relative risk 1·87 (1·29 to 2·73)). Younger pupils used cycles more than older pupils (relative risk 1·27 (1·19 to 1·35)) and were twice as likely to wear a cycle helmet (relative risk 2·38 (1·61 to 3·51)). Deprived pupils used a bicycle less frequently than affluent pupils (relative risk 0·93 (0·87 to 0·99), but the proportions who wore cycle helmets were similarly low.

Discussion

In this study we were able to collect information about unintentional injury risk from a cohort of children cheaply and quickly. With the quality and quantity of data obtained we have a citywide picture of injury risk and can provide profiles of injury risk to individual schools. The 87% response rate represented all pupils who attended the lesson on the day that the questionnaire was administered. This attendance rate is similar to the national average for secondary schools in 1988-9 of 89·5% (range 77%-95%).[7] Most absentees are away from school for legitimate reasons; and only a minority are truants.[8] Further research is needed to investigate whether persistent truants have a different exposure to injury risk than attenders.

In 1990 the rate of 10-14 year old boys attending accident and emergency departments in Newcastle with cycling injuries was 77/10 000 and that of girls was 37/10 000, giving a rate ratio of boys to girls of 2·08:1. Do boys take more risks than girls when they cycle or do they simply cycle more often? From our survey we found that 60% of the boys questioned had ridden a bicycle in the previous week compared with 33% of girls. Thus, boys in Newcastle have nearly twice the exposure to bicycle riding compared with girls. Many of the differences in accident and emergency attendance stem from different exposure rates.

How do our results compare with those of other studies? In Tight's survey in Bradford and Bristol, Nelson, Sheffield, and Reading there were great variations in the number of secondary school pupils who walked to school: from 85% in Bradford to 47% in Reading.[9] Surveys in south and central England reported that 51% of secondary school children walked to school.[10] Our results are similar, with 45·9% of Newcastle children walking to school. Our results are similar to those of Tight in that more children walked home than walked to school and there was less travel by car on the way home. Tight found higher rates of bicycle use on the school journey in southern towns and lower rates in northern towns.[9] In Newcastle 0·8% of pupils cycled to school, conforming with the low rate of use in northern towns. Exposure to injury risk varies with different social, economic, and environmental conditions.

USING SURVEYS TO IMPROVE SAFETY

Not all risks in the road environment are susceptible to change by health promotion. For example, the mode of travel may depend on whether a family has access to a car, and the location of a child's home will determine the number of roads they have to cross. Other factors are more amenable to change: the provision of safe crossing facilities, pupils' use of crossing facilities, the provision of safe play facilities, and the speed of traffic on roads near schools or where children play.

Some changes to reduce children's exposure to the road environment may lead to other problems. Encouraging accompaniment of children on the school journey by adults or encouraging greater use of cars or public transport rather than walking can greatly inhibit a child's freedom. A child's licence to travel on their own or to walk has been greatly reduced over the past 20 years.[10] Higher parental accompaniment by car results in greater road use and more risk to child pedestrians when children are taken to or collected from school. Roberts believes that restricting children's traffic exposure exacerbates socioeconomic differentials in childhood mortality and denies children their right to mobility.[11]

No single intervention can have a dramatic effect on reducing children's exposure to the road environment. A combination of approaches such as traffic calming measures, changing the behaviour of drivers and children, and defining the role of the school can help to reduce risk.[4]

Public health implications

- The government has set targets for reduction of accidents among children aged under 15
- Death rates and rates of admission to hospital for injury do not provide adequate data, especially for small local populations
- In this study self completion questionnaires were used to collect information on exposure to injury risk in schoolchildren aged 11-14 in Newcastle upon Tyne
- In general boys, older pupils, and pupils from poorer households were exposed to greater risk of injury when travelling to and from school and to places for recreation
- Data on exposure to injury risk can provide useful information for local health promotion

CONCLUSION

For many aspects of health promotion, information has been collected on risk factors and has been used to devise achievable goals,[12] but for unintentional injury there is a dearth of information on the risk factors affecting children. Our survey showed differences in risk associated with age, sex, and affluence that can help in targeting specific advice. The value of local data should be emphasised: they can help to educate policy makers and to increase their interest in injury prevention.

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